CERTAIN ASPECTS OF THE METABOLISM OF THE AMINO ACIDS

BY

WILLIAM JOSEPH HAINES

A. B., Wabash College, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN CHEMISTRY
IN THE GRADUATE SCHOOL OF THE UNIVERSITY
OF ILLINOIS, 1943

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PART I

THE AMINO ACID REQUIREMENTS OF MAN

INTRODUCTION

Nitrogen equilibrium studies have been used previously[1] by various workers in order to determine the nutritive significance of the amino acids in animals. Nine of the twenty-two amino acids, generally recognized as components of natural protein, are indispensable. A tenth, arginine, must be included in the diet in order to obtain maximum growth in rats. Corresponding investigations making use of human subjects have shown that valine and methionine[2], as well as threonine and phenylalanine[3], are essential dietary components. The results of the present study complete the qualitative amino acid requirements of man.

EXPERIMENTAL

Adult male subjects were used throughout the experiment. Diets were fed in which about ninety-five percent of the nitrogen was in the form of purified amino acids. Both natural and synthetic acids were ingested. A ration was selected which contained, besides the amino acids, lemon juice, sucrose, butter, cellu-flour, corn oil, minerals, cod liver oil, and a mixture of vitamins. Distilled water was taken *ad libitum*. It was found that 55 calories per kilogram body weight were needed daily by each subject on this diet. If this level of calories was not fed, nitrogen balance could not be attained even though the distribution and total amount of amino acids were adequate.

Twenty-four hour urine samples were collected and preserved under toulene. Fecal periods were marked off with charcoal. The experiment was initiated by feeding the ten

PART III

THE BEHAVIOR OF GLYCOLIC ACID IN PHLORHIZIN DIABETES

INTRODUCTION

The metabolic fate of glycolic acid is not only of interest in itself but also because of the suggested relation of this compound to the intermediary metabolism of glycine. Ringer and Lusk[1] have shown that both carbon atoms of glycine are transformed to glucose in the phlorhizinized dog. Various types of experiments that have been conducted on glycolic acid seem to contradict one another as to whether or not this compound may be a precursor of glucose. Studies carried out previously on the phlorhizinized dog are especially non-convincing in this respect and, in addition, have not included determinations of urinary acetone bodies. The present investigation, in which sodium glycolate was administered to the phlorhizinized dog, was undertaken in an attempt to clarify the metabolic status of glycolic acid.

EXPERIMENTAL

The types of subjects and the procedures used in this study were exactly the same as those described in Chapter II of this abstract. The sodium salt of glycolic acid was administered in water solution by intraperitoneal injection. In contrast to previous studies carried out elsewhere the daily values for total nitrogen, glucose, and acetone bodies in the urine were determined on complete twenty-four hour samples that were accurately collected by catheterization.

SUMMARY

The intraperitoneal injection of sodium glycolate in phlorhizinized dogs does not cause the excretion of "extra glucose" or "extra acetone." Evidently, glycolic acid is not an intermediate in glycine metabolism.

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[1] Ringer, A. I., and Lusk, G., Z. physiol. Chem., **66**, 106 (1910).

VITA

The author was born September 26, 1919, in Crawfordsville, Indiana. He received his elementary and secondary education in the public schools of this city. He attended Wabash College from which he received the Bachelor of Arts Degree in June, 1940. He entered the graduate school of the University of Illinois in September of 1940 as a Special Research Assistant in Chemistry. He held this appointment for the succeeding three years. During the summer semester of 1943 he was a University of Illinois Research Fellow in Chemistry.

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